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COMPLETE SPECIFICATION

Improvements in Vehicle Suspension Systems

We, DUNLOP RUBBER COMPANY LIMITED, a British Company, of 1, Albany Street, London, N.W.1, and ROBERT MAXWELL SEDDON, a British Subject of the aforesaid Company's Works, at Fort Dunlop, Erdington, Birmingham, 24, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to suspension systems for wheeled vehicles.

Suspension systems are known comprising a cylindrical member disposed transversely across the vehicle chassis, a plunger near each end of the cylindrical member connected by linkage to a wheel, and a resilient member interposed between the two plungers and within the cylinder. Such a resilient member may be e.g. a coil spring or a column of rubber discs. It is also known to interpose a resilient buffer between each plunger and the end of the cylindrical member.

In suspension systems of this type the deflections of the wheels relative to the chassis are interdependent since the stress set up in the resilient member by deflection of one wheel is transmitted throughout the length of said member and reacts on the other wheel through its associated plunger. Whilst a limited reaction of this nature is advantageous, since the impact of slight road irregularities is transmitted throughout the length of the resilient member and shared by both wheels, it is undesirable that a large stress, caused, for example, by one wheel passing over a large obstacle, or the vehicle turning a corner at speed, should be transmitted throughout the resilient member. In such cases the tilting of the vehicle is augmented, and this in turn produces an objectionable rolling motion.

The object of the invention is to provide a suspension system for vehicles of the type described combining the advantages of the interdependent type of vehicle suspension with those of the independent type.

According to the invention a resilient device for a vehicle suspension system comprises a cylindrical member, two plungers in said member one at each extremity and each adapted to be associated with a vehicle wheel compressible and resilient means interposed between the said plungers and within the cylindrical member and means for restricting the movement transmitted by one plunger to the other to a predetermined maximum.

In a suspension system in accordance with the present invention the operating member for moving the plunger may be a lever pivotally mounted on the chassis or it may be a piston and cylinder mechanism connected with the plunger by a fluid transmission line.

The compressible and resilient means employed may be a helical spring or a compressible fluid or a combination thereof, but it is preferred to employ a rubber member, particularly in the form of a column of discs in axial alignment. The cylindrical member or other guide means surrounding the compressible and resilient means and the plungers may either form a chassis member or may be a separate member mounted on a transverse chassis member.

In accordance with the invention, for example, wheeled vehicles may be provided with a suspension system comprising resilient means under compression extending transversely of the vehicle, two plungers each of which coacts with one end of said means, a guide means surrounding said resilient means and said plungers, two operating members each associated with one of a pair of opposite wheels and actuated by vertical deflection thereof to move the corresponding plungers, and means for restricting the movement transmitted by one plunger to the other, to a predetermined maximum whereby such deflection of either wheel

results in a change in the degree of compression of the resilient means, such a change reacting upon the other plunger, up to a limit imposed by the restricting means. Within such limits the system is of th interdependent type of suspension. After the maximum imposed by the restricting means has been reached the system becomes of the independent type, only that portion of the resilient means on the same side of the centre line as the deflected wheel being compressed.

The invention will now be more particularly described with reference to the accompanying drawings of which—

Fig. 1 is a sectional elevation of one embodiment of the system.

Fig. 2 is a sectional view of the restricting means in greater detail.

Fig. 3 is a perspective view of one method of mounting the system on the chassis of a motor vehicle.

The device illustrated in Figs. 1 and 2 comprises a cylindrical sleeve 1 extending transversely across the vehicle and enclosing a column made up of a number of rubber discs 2 having a diameter slightly less than the internal diameter of the sleeve, so that there is a clearance between the periphery of the column, and the internal surface of the sleeve. Alignment of the discs is achieved by forming a circular projection 2a on one transverse face of each disc, the diameter of this projection being about half the diameter of the disc, and providing a corresponding depression 2b in the opposite face of each disc, so that each disc meshes with the adjacent disc on either side. In addition the discs of one half of the column face the opposite way to the discs in the other half of the column with the projecting faces directed inwards. These faces of the two central discs are in contact and an annular space is thus formed between the opposing marginal faces of the discs.

An annular stop 23 is secured to the inner periphery of the cylindrical sleeve 1 at a location intermediate its ends, and two dished rings 20, 21 are provided. Each ring comprises a washer-like member from the outer periphery of which extends an axially extending portion terminating in a short outwardly extending portion, the outer periphery of which is a sliding fit in the cylindrical sleeve. These two dished rings are placed together with their washer-like portions abutting one another, and in this condition said washer-like portions fit snugly within the annular space, hereinbefore referred to, between the opposing marginal faces of the centre discs. With the central discs and dished rings positioned in the sleeve, an annular gap 22 is provided between the axially extending portions of the members and the inner periphery of the sleeve, and the annular stop 23 is secured in this gap.

At each end of the column of discs is provided a plunger member 5 the inner face of which has a projection 6 engaging with the depression 2b in the adjacent disc and from the other face of which a shank 7 extends through an open end of the sleeve into pivotal connection with one arm of a lever member 10 as described below. Surrounding the shank within the sleeve and in contact with the plunger is an annular rubber member 8 which has a diameter less than the internal diameter of the sleeve 1 and which flares away from the shank at the end remote from the plunger. The length of this member axially may be such that when the suspension system is under load the transverse face of the member remote from the plunger is either spaced from or in contact with a ring 9 fixed in the end of the sleeve. The function of this member is to absorb the shock arising from rapid outward movement of the plunger when the system is relieved from load. Fixed to the outer face of the annular ring and to the shank is a flexible cap 13 to prevent dust and other extraneous material from entering the sleeve.

The end of the shank 7 is rotatably fixed to one arm of a lever member which is pivotally mounted on the chassis at 11a and which is rotatably connected through the other arm to a wheel mounting. Thus when a wheel is deflected the lever member rotates about its pivot and causes a resultant change in the state of compression of the rubber column which causes rotation of the other lever member 10 and a consequential vertical deflection of the chassis relative to the other wheel.

The operation of the device is best described considering a vertical deflection of the wheel connected to the left hand member 10 of Figure 1. The corresponding plunger member 5 is laterally displaced to the right compressing the rubber discs 2, the discs transmitting the shock to the other wheel through the other plunger member 5 and lever member 10. If the shock is sufficient to compress the rubber discs 2 to the predetermined limit the dished ring 21 is displaced to the right far enough to contact the stop 23. Any increase in the magnitude of the shock compresses the left hand portion only of the rubber discs 2 and no further shock is transmitted to the other wheel.

The distance the rings may travel before meeting the stop can be varied during the manufacture of the system to suit the type of vehicle and the conditions of

service. In general a suitable distance is 1/4" to 1/2".

Figure 3 shows one embodiment of the invention in which the guide means is attached to a vehicle chassis in such a way as to serve as a transverse chassis member. The guide means 1 containing the resilient means is attached to the chassis 13 by means of brackets 14. The members 10, 11, 12 form a linkage of the " wish-bone " type, the stub axle of the wheel being attached to the member 12 by a king-pin.

The construction of the suspension system of the present invention allows of a considerable modification in detail in order to obtain a system having the frequency and other properties preferred by a car manufacturer or individual owner. Thus the relative lengths of the arms of the lever members may be altered. Again, when rubber discs are employed their thickness may vary in accordance with the requirements of the vehicle to which the suspension system is applied some may be replaced by rigid discs made of wood or metal, or metal plates may be inserted between adjacent discs.

The system is of principal importance in connection with motor vehicles, caravans, trailers and other land vehicles but it is also applicable to aeroplanes having a fixed undercarriage.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is :—

1. A resilient device for a vehicle suspension system comprising a cylindrical member, two plungers in said member one at each extremity and each adapted to be associated with a vehicle wheel, compressible and resilient means interposed between the said plungers and within the cylindrical member and means for restricting the movement transmitted by one plunger to the other to a predetermined maximum.

2. A resilient device as claimed in claim 1 wherein the said resilient material is rubber.

3. A resilient device as claimed in Claim 2 wherein the compressible and resilient means comprises a plurality of discs of resilient material, each disc having a projecting portion adapted to fit in a complementary recessed portion of an adjacent disc, whereby said discs are maintained in axial alignment within said cylindrical member.

4. A resilient device as claimed in Claim 1, 2 or 3 wherein a buffer of resilient material surrounding the shank of each plunger is interposed between the said plunger and the end wall of the cylindrical member.

5. A resilient device as claimed in any of the preceding claims wherein the means for restricting the movement transmitted by one plunger to the other comprises an annular stop secured to the middle of the cylindrical member and axially displaceable means engaging with the resilient compressible means and adapted to engage with the annular stop after a predetermined axial displacement in either direction.

6. A vehicle having a suspension system comprising a resilient device extending transversely of the vehicle and comprising a cylindrical member, two plungers in said member one at each extremity, compressible and resilient means interposed between said plungers and within the cylindrical member, means for restricting the movement transmitted by one plunger to the other, to a predetermined maximum and two operating members, each associated with one of said plungers and with one of a pair of opposite wheels and actuated by the vertical movement of said wheel, whereby the vertical movement of each wheel is communicated to its associated plunger and reacts upon the other plunger up to the maximum imposed by said restricting means by changing the degree of compression of the said compressible and resilient means.

7. A vehicle as claimed in Claim 6 wherein the resilient means comprises a plurality of discs of resilient material, each disc having a projecting portion adapted to fit in a complementary recessed portion of an adjacent disc, and a buffer of resilient material surrounding the shank of each plunger is interposed between the said plunger and the end wall of the cylindrical member.

8. A vehicle as claimed in Claim 6 or 7 wherein each operating member comprises a bell crank lever pivotally mounted on the chassis, one arm being rotatably connected to the shank of the said plunger and the other arm being rotatably connected to the wheel mounting.

9. A vehicle as claimed in any of Claims 6, 7 and 8 wherein the said resilient device is a structural member of the chassis.

10. A vehicle having a suspension system constructed and arranged substantially as described herein and shown in the accompanying drawings.

Dated this 24th day of February, 1948.

R. F. McKAY,
Acting for the Applicants.

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[This Drawing is a reproduction of the Original on a reduced scale.]

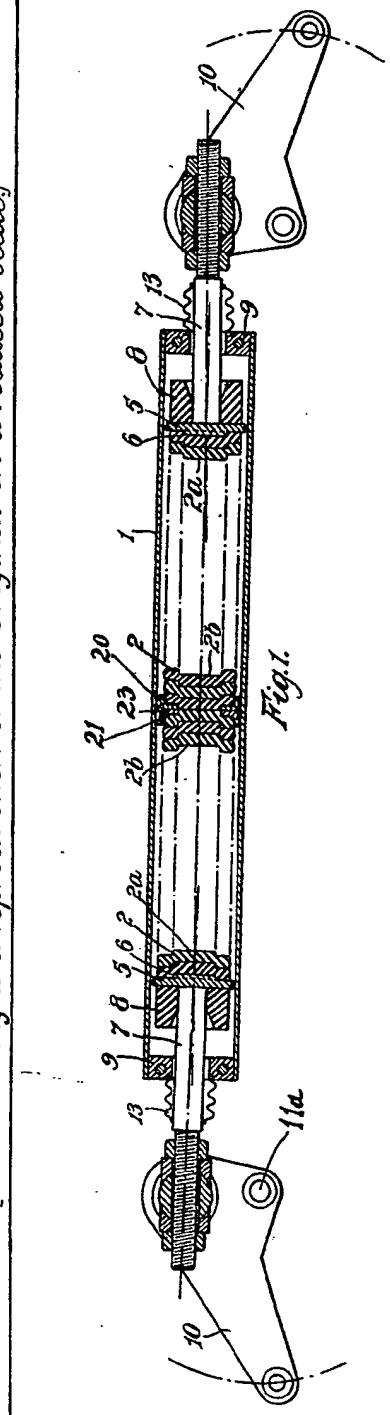

Fig. 1.

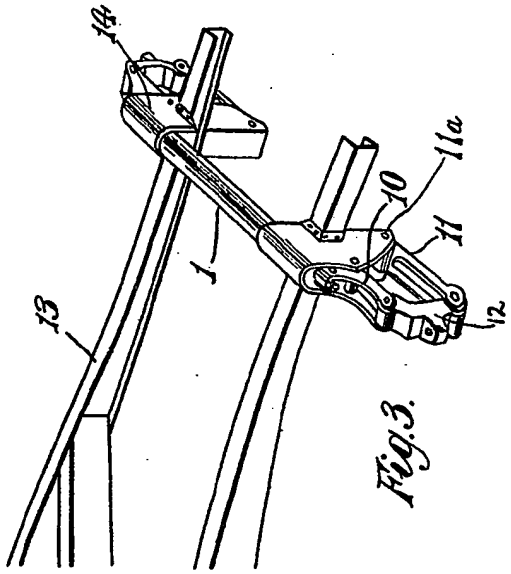

Fig. 3.

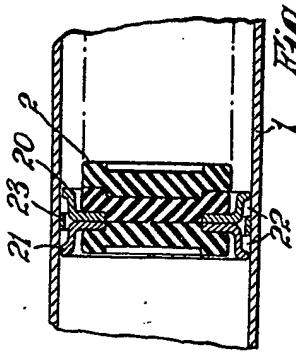

Fig. 2.

H.M.S.O.(Ty. P.)